

CLAIMS:

1. A liquid crystal display panel, comprising:

5        a first substrate including a first alignment film that has been alignment processed in a first alignment processing direction;

10      a second substrate arranged in opposition to the first substrate, including a second alignment film that has been alignment processed in a second alignment processing direction; and

15      a liquid crystal layer arranged between the first substrate and the second substrate, having a twisted alignment structure in its initial alignment state, wherein a liquid crystal injection direction, in which liquid crystal material is injected to form the liquid crystal layer, is parallel to a direction dividing an intersection angle defined by the first alignment processing direction and the second alignment processing direction into two equal angles or substantially equal angles.

2. The liquid crystal panel according to Claim 1, wherein the first alignment film and the second alignment film have received their liquid crystal aligning ability in a rubbing process.

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3. The liquid crystal panel according to Claim 2, wherein the first alignment film and the second alignment film are made of polyimide-based resin films.

4. The liquid crystal panel according to Claim 2, wherein the first alignment film and the second alignment film are made of films, in which a group of film molecules including a straight carbon chain is bonded / fixed to a surface of the substrates with siloxane bonds.

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5. The liquid crystal panel according to Claim 4, wherein the first alignment film and the second alignment film are made of monomolecular adsorption films or polymer adsorption films.

10 6. The liquid crystal panel according to Claim 1, wherein the first alignment film and the second alignment film are photosensitive alignment films including film molecules with photosensitive groups, the photosensitive alignment films having received their liquid crystal aligning ability in a photoalignment process.

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7. The liquid crystal panel according to Claim 6, wherein the first alignment film and the second alignment film are made of polyimide-based resin films.

20 8. The liquid crystal panel according to Claim 6, wherein the first alignment film and the second alignment film are made of films, in which a group of film molecules including a straight carbon chain is bonded / fixed to a surface of the substrates with siloxane bonds.

9. The liquid crystal panel according to Claim 8, wherein the first alignment film and the second alignment film are made of monomolecular adsorption films or polymer adsorption films.

5 10. A liquid crystal display panel, comprising:  
a first substrate including a first alignment film that has been  
alignment processed in a first alignment processing direction;  
a second substrate arranged in opposition to the first substrate,  
including a second alignment film that has been alignment processed in a  
10 second alignment processing direction; and  
a liquid crystal layer arranged between the first substrate and the  
second substrate, having a twisted alignment structure in its initial  
alignment state, wherein a liquid crystal injection direction, in which liquid  
crystal material is injected to form the liquid crystal layer, is perpendicular  
15 to a direction dividing an intersection angle defined by the first alignment  
processing direction and the second alignment processing direction into two  
equal angles or substantially equal angles.

11. The liquid crystal panel according to Claim 10, wherein the first  
20 alignment film and the second alignment film have received their liquid  
crystal aligning ability in a rubbing process.

12. The liquid crystal panel according to Claim 11, wherein the first  
alignment film and the second alignment film are made of polyimide-based

resin films.

13. The liquid crystal panel according to Claim 11, wherein the first alignment film and the second alignment film are made of films, in which a group of film molecules including a straight carbon chain is bonded / fixed to a surface of the substrates with siloxane bonds.

14. The liquid crystal panel according to Claim 13, wherein the first alignment film and the second alignment film are made of monomolecular adsorption films or polymer adsorption films.

15. The liquid crystal panel according to Claim 10, wherein the first alignment film and the second alignment film are photosensitive alignment films including film molecules with photosensitive groups, the photosensitive alignment films having received their liquid crystal aligning ability in a photoalignment process.

16. The liquid crystal panel according to Claim 15, wherein the first alignment film and the second alignment film are made of polyimide-based resin films.

17. The liquid crystal panel according to Claim 15, wherein the first alignment film and the second alignment film are made of films, in which a group of film molecules including a straight carbon chain is bonded / fixed to

a surface of the substrates with siloxane bonds.

18. The liquid crystal panel according to Claim 17, wherein the first alignment film and the second alignment film are made of monomolecular 5 adsorption films or polymer adsorption films.

19. A liquid crystal display panel, comprising:

a first substrate including a first alignment film that has been alignment processed in a first alignment processing direction;

10 a second substrate arranged in opposition to the first substrate, including a second alignment film that has been alignment processed in a second alignment processing direction parallel to the first alignment processing direction; and

15 a liquid crystal layer arranged between the first substrate and the second substrate, having a homogeneous alignment structure in its initial alignment state, wherein a liquid crystal injection direction, in which liquid crystal material is injected to form the liquid crystal layer, is arranged to be parallel to the first alignment processing direction and the second alignment processing direction.

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20. The liquid crystal panel according to Claim 19, wherein the first alignment film and the second alignment film are photosensitive alignment films including film molecules with photosensitive groups, the photosensitive alignment films having received their liquid crystal aligning

ability in a photoalignment process.

21. The liquid crystal panel according to Claim 20, wherein the first alignment film and the second alignment film are made of polyimide-based resin films.

22. The liquid crystal panel according to Claim 20, wherein the first alignment film and the second alignment film are made of films, in which a group of film molecules including a straight carbon chain is bonded / fixed to a surface of the substrates with siloxane bonds.

23. The liquid crystal panel according to Claim 22, wherein the first alignment film and the second alignment film are made of monomolecular adsorption films or polymer adsorption films.

15 24. A method for manufacturing a liquid crystal display panel, comprising:

20 an alignment film formation step of forming a first alignment film on a first substrate, and a second alignment film on a second substrate arranged in opposition to the first substrate;

an alignment processing step of alignment processing the first alignment film in a first alignment processing direction and alignment processing the second alignment film in a second alignment processing direction;

a sealing member formation step of forming on either the first substrate or the second substrate a frame-shaped sealing member having an open portion serving as a liquid crystal injection port;

an aligning step of aligning the pair of substrates together at a predetermined spacing, such that the first alignment film and the second alignment film are arranged in opposition to one another, and the first alignment processing direction and the second alignment processing direction rotated for a finite angle with respect to one another; and

a liquid crystal injection step of injecting liquid crystal material through the liquid crystal injection port to form a liquid crystal layer having a twisted alignment structure in its initial alignment state;

wherein an aperture direction of the liquid crystal injection port in the sealing member formation step is parallel to a direction dividing an intersection angle defined by the first alignment processing direction and the second alignment processing direction into two equal angles or substantially equal angles, and wherein the liquid crystal injection direction when injecting the liquid crystal material through the liquid crystal injection port in the liquid crystal injection step is parallel to the direction dividing the intersection angle defined by the first alignment processing direction and the second alignment processing direction into two equal angles or substantially equal angles.

25. The method for manufacturing a liquid crystal panel according to Claim 24, wherein the alignment processing step includes a rubbing process.

26. The method for manufacturing a liquid crystal panel according to  
Claim 24, wherein photosensitive alignment films are used as the first  
alignment film and the second alignment film, and the alignment processing  
5 step includes a photoalignment process in which alignment processing is  
performed by irradiating light that is polarized in a predetermined  
direction.

27. A method for manufacturing a liquid crystal display panel,  
10 comprising:

an alignment film formation step of forming a first alignment film on  
a first substrate, and a second alignment film on a second substrate  
arranged in opposition to the first substrate;

an alignment processing step of alignment processing the first  
15 alignment film in a first alignment processing direction and alignment  
processing the second alignment film in a second alignment processing  
direction;

a sealing member formation step of forming on either the first  
substrate or the second substrate a frame-shaped sealing member having  
20 an open portion serving as a liquid crystal injection port;

an aligning step of aligning the pair of substrates together at a  
predetermined spacing, such that the first alignment film and the second  
alignment film are arranged in opposition to one another, and the first  
alignment processing direction and the second alignment processing

direction rotated for a finite angle with respect to one another; and

a liquid crystal injection step of injecting liquid crystal material through the liquid crystal injection port to form a liquid crystal layer having a twisted alignment structure in its initial alignment state;

5       wherein an aperture direction of the liquid crystal injection port in the sealing member formation step is perpendicular to a direction dividing an intersection angle defined by the first alignment processing direction and the second alignment processing direction into two equal angles or substantially equal angles, and the liquid crystal injection direction when  
10 injecting the liquid crystal material through the liquid crystal injection port in the liquid crystal injection step is perpendicular to the direction dividing the intersection angle defined by the first alignment processing direction and the second alignment processing direction into two equal angles or substantially equal angles.

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28.     The method for manufacturing a liquid crystal panel according to Claim 27, wherein the alignment processing step includes a rubbing process.

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29.     The method for manufacturing a liquid crystal panel according to Claim 27, wherein photosensitive alignment films are used as the first alignment film and the second alignment film, and the alignment processing step includes a photoalignment process in which alignment processing is performed by irradiating light that is polarized in a predetermined direction.

30. A method for manufacturing a liquid crystal display panel, comprising:

an alignment film formation step of forming a first alignment film on  
5 a first substrate, and a second alignment film on a second substrate  
arranged in opposition to the first substrate;

an alignment processing step of alignment processing the first  
alignment film in a first alignment processing direction and alignment  
processing the second alignment film in a second alignment processing  
10 direction;

a sealing member formation step of forming on either the first  
substrate or the second substrate a frame-shaped sealing member having  
an open portion serving as a liquid crystal injection port;

an aligning step of aligning the pair of substrates together at a  
15 predetermined spacing, such that the first alignment film and the second  
alignment film are arranged in opposition to one another, and the first  
alignment processing direction and the second alignment processing  
direction are arranged to be parallel or substantially parallel to one another;  
and

20 a liquid crystal injection step of injecting liquid crystal material  
through the liquid crystal injection port to form a liquid crystal layer having  
a homogeneous alignment structure in its initial alignment state;

wherein an aperture direction of the liquid crystal injection port in  
the sealing member formation step is parallel to the first alignment

processing direction and the second alignment processing direction, and the liquid crystal injection direction when injecting the liquid crystal material through the liquid crystal injection port in the liquid crystal injection step is parallel to the first alignment processing direction and the second alignment 5 processing direction.

31. The method for manufacturing a liquid crystal panel according to Claim 30, wherein photosensitive alignment films are used as the first alignment film and the second alignment film, and the alignment processing 10 step includes a photoalignment process in which alignment processing is performed by irradiating light that is polarized in a predetermined direction.

32. A liquid crystal display panel having a liquid crystal cell, 15 wherein the liquid crystal cell includes at least one liquid crystal injection port provided on a rim of an empty cell made by disposing a sealing member between a pair of substrates;

wherein the liquid crystal cell is made by injecting liquid crystal through the liquid crystal injection port into the empty cell; and

20 wherein the liquid crystal injection port is arranged such that a liquid crystal injection direction substantially matches a direction for which, in a projection plane obtained by projecting structural elements inside the liquid crystal layer except for supporting members for holding a predetermined spacing between the pair of substrates in a direction parallel

to the substrate plane onto a projection plane, the area of the region taken up by an empty portion, which is obtained by subtracting the projection area of the structural elements from the total projection area, becomes largest.

5 33. The liquid crystal display panel according to Claim 32,  
wherein an alignment film is provided on an inner side of each of the  
two substrates; and

wherein the alignment processing direction of the alignment films  
substantially matches the liquid crystal injection direction and the direction  
10 for which the area of the region taken up by the empty portion becomes  
largest.

34. A liquid crystal display panel having a liquid crystal cell,  
wherein the liquid crystal cell includes at least one liquid crystal  
15 injection port provided on a rim of an empty cell made by disposing a sealing  
member between a pair of substrates;

wherein the liquid crystal cell is made by injecting liquid crystal  
through the liquid crystal injection port into the empty cell; and

wherein, when there are a plurality of directions for which, in a  
20 projection plane obtained by projecting structural elements inside the liquid  
crystal layer except for supporting members for holding a predetermined  
spacing between the pair of substrates in a direction parallel to the  
substrate plane onto a projection plane, the area of the region taken up by  
an empty portion, which is obtained by subtracting the projection area of the

structural elements from the total projection area, becomes largest, then the liquid crystal injection port is arranged such that the liquid crystal injection direction substantially matches a direction at which a flow path of the liquid crystal is ensured best.

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35. A liquid crystal display panel having a liquid crystal cell, wherein the liquid crystal cell includes at least one liquid crystal injection port provided on a rim of an empty cell made by disposing a sealing member between a pair of substrates;

10 wherein the liquid crystal cell is made by injecting liquid crystal  
through the liquid crystal injection port;

wherein the liquid crystal display panel modulates light passing through the liquid crystal cell with a transversal electric field component applied in parallel to the substrate to display images;

15 wherein an electrode pair is provided on one substrate of the pair of  
substrates; and

wherein the liquid crystal injection port is arranged such that the liquid crystal injection direction when injecting the liquid crystal substantially matches an extension direction of the electrodes.

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36. The liquid crystal display panel according to Claim 35,  
wherein an alignment film is provided on an inner side of each of the

<sup>1</sup> See also the discussion of the 'new' in the 'old' in the section on 'The New in the Old'.

substantially matches the extension direction of the electrodes and the liquid crystal injection direction.

37. The liquid crystal display panel according to Claim 35, wherein the  
5 electrodes have a plurality of bending points, and while the electrodes are  
bent at each of the bending points in alternating directions, they extend  
overall in a predetermined direction.

38. The liquid crystal display panel according to Claim 35, wherein the  
10 electrode pair is a pair of stripe-shaped parallel electrodes.

39. The liquid crystal display panel according to Claim 35, wherein the  
electrode pair includes two hook-shaped electrode portions having a long  
side and short sides defining a certain angle, with two ends of the  
15 hook-shaped electrode portions pointing in different directions.

40. The liquid crystal display panel according to Claim 35, wherein the  
alignment films are alignment processed by rubbing.

20 41. The liquid crystal display panel according to Claim 35, wherein the  
alignment films are made of polyimide-based resin.

42. The liquid crystal display panel according to Claim 35, wherein the  
alignment films are alignment processed by photoalignment.

43. The liquid crystal display panel according to Claim 35, wherein the alignment films are made of monomolecular adsorption films or polymer adsorption films in which clusters of film molecules constituting the 5 alignment films are bonded / fixed to a surface of the substrates.

44. A liquid crystal display panel having a liquid crystal cell, wherein the liquid crystal cell includes at least one liquid crystal injection port provided on a rim of an empty cell made by disposing a sealing 10 member between a pair of substrates; wherein the liquid crystal cell is made by injecting liquid crystal through the liquid crystal injection port; wherein the liquid crystal display panel modulates light passing through the liquid crystal cell with a transversal electric field component 15 applied in parallel to the substrate to display images; wherein an electrode pair is provided on one substrate of the pair of substrates; wherein a color filter is arranged on the inside of the other substrate, the color filter being provided with a color pattern of red, green and blue and 20 a light-blocking film arranged between the colors; and wherein the liquid crystal injection port is arranged such that the liquid crystal injection direction when injecting the liquid crystal substantially matches an extension direction of a thickest portion of the light-blocking film.

45. The liquid crystal display panel according to Claim 44,  
wherein an alignment film is provided on an inner side of each of the  
two substrates; and

5 wherein the alignment processing direction of these alignment films  
substantially matches the liquid crystal injection direction and the  
extension direction of the thickest portion of the light-blocking film.

46. The liquid crystal display panel according to Claim 44, wherein an  
10 extension direction of the electrodes substantially matches the alignment  
processing direction of the alignment films, an aperture direction of the  
liquid crystal injection port, and the extension direction of the thickest  
portion of the light-blocking film.

15 47. The liquid crystal display panel according to Claim 44, wherein the  
electrodes have a plurality of bending points, and while the electrodes are  
bent at each of the bending points in alternating directions, they extend  
overall in a predetermined direction.

20 48. The liquid crystal display panel according to Claim 44, wherein the  
electrode pair is a pair of stripe-shaped parallel electrodes.

49. The liquid crystal display panel according to Claim 44, wherein the  
electrode pair includes two hook-shaped electrode portions having a long

side and short sides defining a certain angle, with two ends of the hook-shaped electrode portions pointing in different directions.

50. The liquid crystal display panel according to Claim 45, wherein the  
5 alignment films are alignment processed by rubbing.

51. The liquid crystal display panel according to Claim 50, wherein the alignment films are made of polyimide-based resin.

10 52. The liquid crystal display panel according to Claim 45, wherein the alignment films are alignment processed by photoalignment.

15 53. The liquid crystal display panel according to Claim 45, wherein the alignment films are made of monomolecular adsorption films or polymer adsorption films in which clusters of film molecules constituting the alignment films are bonded / fixed to a surface of the substrates.

~~54.~~ A method for manufacturing a liquid crystal display panel having a liquid crystal cell,

20 wherein the liquid crystal cell includes at least one liquid crystal injection port provided on a rim of an empty cell made by disposing a sealing member between a pair of substrates; and

wherein the liquid crystal cell is made by injecting liquid crystal through the liquid crystal injection port;

the method comprising:

a sealing member formation step of forming on one of the two substrates a frame-shaped sealing member having at least one open portion serving as a liquid crystal injection port;

5 an aligning step of providing supporting members on one of the two substrates, and aligning the pair of substrates together at a predetermined spacing, forming an empty cell; and

a liquid crystal injection step of injecting liquid crystal material through the liquid crystal injection port to form a liquid crystal cell;

10 wherein in the sealing member formation step, the sealing member is formed such that the liquid crystal injection direction when injecting the liquid crystal substantially matches a direction in which a flow resistance due to structural elements posing an obstacle for liquid crystal flow that are inside the liquid crystal layer, except the supporting members for holding a 15 predetermined spacing between the pair of substrates, becomes minimal.

55. A method for manufacturing a liquid crystal display panel having a liquid crystal cell,

wherein the liquid crystal cell includes at least one liquid crystal 20 injection port provided on a rim of an empty cell made by disposing a sealing member between a pair of substrates; and

wherein the liquid crystal cell is made by injecting liquid crystal through the liquid crystal injection port;

the method comprising:

an electrode formation step of forming a pair of electrodes on one of the two substrates;

a sealing member formation step of forming on one of the two substrates a frame-shaped sealing member having at least one open portion 5 serving as a liquid crystal injection port;

an aligning step of providing supporting members on one of the two substrates, and aligning the pair of substrates together at a predetermined spacing, forming an empty cell; and

10 a liquid crystal injection step of injecting liquid crystal material through the liquid crystal injection port to form a liquid crystal cell;

wherein in the sealing member formation step, the sealing member is formed such that the liquid crystal injection direction when injecting the liquid crystal substantially matches an extension direction of the electrodes.

15 56. The method for manufacturing a liquid crystal display panel according to Claim 55, further comprising:

an alignment film formation step of forming alignment films on the two substrates; and

20 an alignment processing step of alignment processing the alignment films;

wherein in the sealing member formation step, the sealing member is provided with the liquid crystal injection port such that the alignment processing direction in the alignment processing step substantially matches the liquid crystal injection direction.

57. A method for manufacturing a liquid crystal display panel having a liquid crystal cell,

wherein the liquid crystal cell includes at least one liquid crystal injection port provided on a rim of an empty cell made by disposing a sealing member between a pair of substrates; and

wherein the liquid crystal cell is made by injecting liquid crystal through the liquid crystal injection port;

the method comprising:

10 a color filter formation step of forming on one of the two substrates a color filter including a color pattern of R (red), G (green) and B (blue) and a light-blocking film separating these colors;

15 a sealing member formation step of forming on one of the two substrates a frame-shaped sealing member having at least one open portion serving as a liquid crystal injection port;

an aligning step of providing supporting members on one of the two substrates, and aligning the pair of substrates together at a predetermined spacing, forming an empty cell; and

20 a liquid crystal injection step of injecting liquid crystal material through the liquid crystal injection port to form a liquid crystal cell;

wherein in the sealing member formation step, the sealing member is formed such that the liquid crystal injection direction when injecting the liquid crystal substantially matches an extension direction of a highest portion of the light-blocking film.

58. The method for manufacturing a liquid crystal display panel according to Claim 57, further comprising:

an electrode formation step of forming a pair of electrodes on one of  
5 the two substrates;

wherein in the sealing member formation step, the sealing member is provided with the liquid crystal injection port such that the liquid crystal injection direction substantially matches an extension direction of the electrodes.

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59. The method for manufacturing a liquid crystal display panel according to Claim 58, further comprising:

an alignment film formation step of forming alignment films on the two substrates; and

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an alignment processing step of alignment processing the alignment films;

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wherein in the sealing member formation step, the sealing member is provided with the liquid crystal injection port such that the liquid crystal injection direction substantially matches the extension direction of the electrodes and the alignment processing direction in the alignment processing step.